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An Equation for the "Sum of Squares equal a Square" by R. J. ADCOCK, Larchland, Illinois.

The following identical equation for the sum of squares=a square, I have not seen published. If  $u=x+y+z+v+w$ ,  $u^2=x^2+y^2+z^2+v^2+w^2+2xy+2xz+2xv+2yz+2yv+2vw+2zv+2zw+2vw$ ; and if the sum of products

two in a set=0,  $u^2=x^2+y^2+z^2+v^2+w^2$ ,  $w=-\frac{xy+xz+xv+yz+yv+zv}{x+y+z+v}$ ,

$$u^2=x^2+y^2+z^2+v^2+\left(\frac{xy+xz+xv+yz+yv+zv}{x+y+z+v}\right)^2=$$

$$\left[x+y+z+v-\left(\frac{xy+xz+xv+yz+yv+zv}{x+y+z+v}\right)\right]^2.$$

Clearing of fractions and reducing,  $[x(x+y+z+v)]^2+y^2(x+y+z+v)^2+z^2(x+y+z+v)^2+v^2(x+y+z+v)^2+(xy+xz+xv+yz+yv+zv)^2=(x^2+y^2+z^2+v^2+xy+xz+xv+yz+yv+zv)^2$ . True for three or any greater number of letters.

COMMENT.—In the solution of problem 21, page 163, Vol. II, May No., Dr. Martin uses an ingenious method for finding a general formula "to find nine integral square numbers whose sum is a square number."

The same formula, expressed for finding  $n$  integral square numbers whose sum is a square number, may be produced, more directly, from  $(2pq)^2+(p^2-q^2)^2=(p^2+q^2)^2$ . Put  $p^2=m_1^2+m_2^2+m_3^2+\dots+m_{n-1}^2$  and  $q^2=m_n^2$ , in which  $m_1, m_2, m_3, \dots, m_n$  represent any  $n$  integers.

We readily obtain  $(2m_1m_n)^2+(2m_2m_n)^2+(2m_3m_n)^2+\dots+(2m_{n-1}m_n)^2+(m_1^2+m_2^2+m_3^2+\dots+m_{n-1}^2-m_n^2)^2=(m_1^2+m_2^2+m_3^2+\dots+m_n^2)^2$ .

*Illustration.* Let  $n=9$ , and put  $m_1=1$ ,  $m_2=2$ ,  $m_3=3$ ,  $m_4=4$ ,  $m_5=5$ ,  $m_6=6$ ,  $m_7=7$ ,  $m_8=8$ , and  $m_9=9$ . Substituting these values in the formula and dividing by 12, we obtain  $1^2+2^2+3^2+4^2+5^2+6^2$   
 $+7^2+8^2+14^2=20^2$ .

## PROBLEMS.

37. Proposed by A. H. BELL, Hillsboro, Illinois.

Find the first four, integral values of  $n$  in  $\frac{n(5n-3)}{2}=\square$ .

This is the general form of septagonal numbers, 1, 7, 18, 34, 55, etc.

38. Proposed by H. C. WILKES, Skull Run West Virginia.

Let  $n$  be any number and let  $n^3+1=x$ . Then  $x^3+(2x-3)^3+(nx-3n)^3=n^3x^3$ . How can this be demonstrated; it will always be found true on trial.

39. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pennsylvania.

The  $m$ th root of the  $n$ th power of an integral number is a perfect  $p$ th power. What is the number?